REMARKS

Status of the Claims:

Claims 58 – 76 are pending.

Claims 58 – 76 stand rejected.

Claims 59 – 76 are objected to.

Claims 58, 59, 61 – 64, 66, 67, 69, and 74 are currently amended.

Amendments to the Claims:

No new matter has been introduced by way of the claim amendments.

Claim 58 has been amended to clarify that the plurality of molecular circuit components is configured by mortal switching. Support for this amendment may be found in at least paragraph [0159]. Claim 58 has also been amended to state that the random nano-network comprises a plurality of molecular circuit components and a plurality of nanoparticles. Support for this amendment may be found in at least paragraphs [0029], [0034], [0041], [0042], [0043], and [0070]. Claim 58 has also been amended to recite that the plurality of molecular circuit components interconnect at least a portion of the plurality of nanoparticles to provide electrical continuity. Support for this amendment may be found in at least paragraphs [0042] and [0043]. All other amendments to claim 58 are purely for stylistic purposes to improve readability.

Claim 64 has been amended to recite that the plurality of molecular circuit components "comprises" rather than "includes."

Claim 69 has been amended to provide clarity regarding when the repeating steps result in the nanocell functioning as the electronic component. The phrase "the repeating step is performed until the plurality of molecular circuit components is reconfigured such that the nanocell is set to a desired state to function as the electronic component" has been added to improve the clarity of this claim. Support for this claim amendment may be found in at least paragraph [0069].

Claim 74 has been amended to recite that the plurality of molecular circuit components self-assemble into a random molecular interconnect between at least a portion of the plurality of the nanoparticles. Support for this claim amendment may be found in at least paragraph [0043].

All other amendments to the claims have been made to correct typographical errors, for stylistic purposes, or to provide proper antecedent basis to the claims as amended.

I. Priority

Applicants acknowledge Examiner's recognition of priority claim to United States Patent Application 60/220,790, filed July 25, 2000. Office Action Item 1.

II. Claim Objections

The Examiner has objected to claims 59 – 76 due to informalities in the claim dependence of claims 59 and 67. Claims 59 and 67 improperly depend from cancelled claims 1 and 6. Applicants also respectfully point out the claims 66 and 74 also have an improper dependence from cancelled claim 1. Applicants have amended claims 59, 66, 67 and 74 to provide proper dependence within the pending listing of the claims.

III. Claim Rejections Under 35 U.S.C. § 101

The Examiner has rejected claims 58 – 76 under 35 U.S.C. § 101 as directed to non-statutory subject matter. Applicants respectfully traverse this rejection.

The Examiner has stated that claims 58 – 76 are drawn to a process for making an electronic component comprising providing a self-assembled nanocell, programming the nanocell, and configuring the molecular circuit components of the nanocell. The Examiner has stated that the steps of providing, programming, and configuring involve algorithms and computations conducted on the nanocell that can be carried out on a simulated nanocell *in silico*. The Examiner has alleged that since providing a nanocell may be modeled as a computer simulation, the claims have a non-statutory embodiment. The Examiner has stated that the claims are, therefore, subject to the application of judicial exception. The Examiner has stated that inventions subject to judicial exception must include either a physical transformation or

produce a useful, concrete, and tangible result. The Examiner has alleged that the instant claims have an embodiment that does not include a step of physical transformation or a useful, concrete, and tangible result.

Although nanocells may be modeled *in silico* as described in Applicants' disclosure, Applicants respectfully assert that the Examiner has interpreted results of the *in silico* modeling far beyond Applicants' intent. Just because an article can be modeled in a simulation does not necessarily mean than the simulation constitutes an embodiment of the article. Nanocells, as disclosed by Applicants, are real chemical entities. For example, Applicants' disclosure describes nanocells in the following way in paragraph [0011]: "The nanocells of the present invention have the advantage that a single nanocell that is assembled by straightforward wet chemical techniques may be programmed first to perform as one logic unit and then optionally reprogrammed to function as another logic unit." Paragraphs [0025] through [0040] describe nanocell components such as molecular circuit components, input leads, output leads, alligator clips, nanoparticles, and nanoscale components. Each of these nanocell components are real-world chemical entities. Paragraph [0061] describes configuring the molecular circuit components in the nanocell.

Applicants describe the following terms in paragraph [00138]: omniscience, omnipotence, and mortal switching. Omniscience refers to a condition in which all connections, locations, and states of all switches in a nanocell are known. Omnipotence refers to a condition in which a search algorithm knows all the connections, locations, and states of all switches in a nanocell. Computer modeling of nanocells, as performed by Applicants, utilizes an omnipotent programming algorithm. In contrast, in a physical nanocell, there is no omniscience or omnipotence available to the programming algorithm. Such a condition is referred to as mortal switching by Applicants. Mortal switching in a programming algorithm is limited to voltage pulses applied to the input and output leads of the nanocell. Applicants disclose in paragraph [00138] that physical nanocells are programmed in a mortal fashion, and that switching occurs only through voltages pulses applied to the nanocells.

Applicants have amended claim 58 to recite that programming comprises configuring the plurality of molecular circuit components by mortal switching. This claim amendment clarifies

Applicants' intention that the claims are directed to physical embodiments of nanocells. Claim 58 also recites that configuring comprises applying a voltage across the at least one input lead and the at least one output lead to adjust a conductivity-affecting property. Adjustment of a conductivity-affecting property is a tangible result that can be measured in a physical nanocell. Applicants therefore assert that independent claim 58 and dependent claims 59 – 76 are directed to statutory subject matter under 35 U.S.C. § 101. Since the claims are directed to statutory subject matter, Applicants respectfully request that the Examiner's rejections of claims 58 – 76 under 35 U.S.C. § 101 be withdrawn in view of the remarks and amendments presented hereinabove.

IV. Claim Rejections Under 35 U.S.C. § 112, 2nd Paragraph

The Examiner has stated that claim 61 has been rejected under 35 U.S.C. § 112 as being indefinite for failing to particularly point out and distinctly claim the subject matter which the Applicants regard as the invention. Office Action items 2 and 3. The Examiner has stated that the "providing" recited in claim 61 does not have sufficient antecedent basis in preceding claims 60, 59 and 58. Claim 60 depends from claim 59. Claim 59 depends from independent claim 58. The Examiner has stated that "providing" recited in claim 58 does not recite providing a molecular switch or any recitation of a molecular switch.

Applicants have amended claim 61 to read as follows:

61. The method according to claim 60 further comprising connecting at least one of the molecular switches to one of the at least one input lead and the at least one output lead.

Applicants respectfully submit that claim 61, as amended, complies with 35 U.S.C. § 112, 2nd Paragraph.

V. Claim Rejections Under 35 U.S.C. § 103

The Examiner has stated that claims 58 – 59 and 61 – 76 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Andres *et al.*, (*Science*, **1996:**272, pp. 1323 – 1325) in view of Tour *et al.*, (*J. Am. Chem. Soc.*, **1998**:120, pp. 8486 – 8493). Office Action item 6. Applicants also acknowledge their obligation under 37 CFR 1.56 to point out any non-commonly

owned patent applications at the time of the invention. Office Action item 5. Applicants respectfully traverse rejections of the claims under 35 U.S.C. § 103(a).

The Examiner has stated that Andres teaches a self-assembled nanostructure as a basis for nano-electronic digital circuits. The Examiner has stated that the nanostructure is a self-assembly of single-crystal metal clusters (i.e., a random nano-network) arranged in a rigid superlattice. The Examiner has stated that the nanoparticles (metal clusters) have a functionality of electrical connectors to form molecular circuit components as in claim 58. Office Action item 7. The Examiner has stated that Andres teaches applying a voltage across the nano-network, wherein each junction of the nanocell has a capacitance resistance, tunneling rate, and bias voltage adjusted in a "Coulomb staircase" as in claim 58. Office Action item 8. The Examiner has stated that Andres teaches interconnecting the gold clusters with a self-assembled monolayer through covalent bonding as in claim 74. Office Action item 9. The Examiner has stated that Andres teaches a film thickness of 0.83 nm as in claim 76. Office Action item 10. The Examiner has stated that Andres teaches testing the performance of the nanocell as in claims 66 and 69. Office Action item 11. The Examiner has stated that Andres does not teach an input lead or output lead as recited in claim 58 or alligator clips as in claim 74.

The Examiner has stated that Tour teaches molecular devices configured to behave as electronic devices. The Examiner has stated that Tour teaches input and output currents and input and output gates as required in claim 58. The Examiner has stated that Tour also teaches a random nano-network of molecular circuit components and adjustment of a conductivity-affecting property of the molecular circuit components by reshaping electron density through the input signals as in claim 58. The Examiner has stated that Tour teaches the possibility of self-assembly of the molecular circuit elements. Office Action item 13. The Examiner has stated that Tour teaches molecular switches, resonant tunneling diodes, and switches connected to input and output leads for receiving signals as in claims 59, 61 and 62. Office Action items 14 and 15. The Examiner has stated that Tour teaches regions of molecules having negative electrostatic potential, conjugated molecules, and reshaping electron density by input signals as in claims 63, 64 and 65. Office Action items 16 – 18. The Examiner has stated that Tour teaches a self-adaptive algorithm for reshaping electron density as in claims 67, 68 and 69. Office Action item 19. The Examiner has stated that Tour teaches a logic unit and AND, OR, NOR, and NAND as

in claims 70 and 72. Office Action item 20. The Examiner has stated that Tour teaches logical tables, memory and CPU, alligator clips, and alligator clips selected from thiol moieties as in claims 71, 73, 74 and 75. Office Action items 21 – 24.

The Examiner has alleged a *prima facie* case of obviousness against the instant application. The Examiner has stated that it would have been obvious to one of ordinary skill in the art to make a cell-shaped molecular device (nanocell) as taught by Andres and connect the nanocell with input and output leads for transmitting a current as taught by Tour. The Examiner has stated that one would be motivated to combine the method taught by Andres with that taught by Tour, since Tour teaches the usefulness of molecular devices as components of computational devices and the use of self-assembling particles. The Examiner has stated that both Andres and Tour teach organizing molecules to be used as electronic components. Office Action item 25.

Andres teaches single-crystal gold clusters covalently bound to a gold surface though double-ended aryl and alkyl thiols. This arrangement forms a rigid superlattice of gold clusters on a double-ended thiol monolayer. Andres teaches that the double-ended thiol monolayer acts as an insulator layer between the gold clusters and the gold surface (page 1324, column 2, paragraph 2). Other than the gold surface to which the gold clusters are bound through the thiol monolayer molecules, the individual gold clusters are not otherwise interconnected as taught by Andres. Since Andres teaches that the thiol monolayer is an insulator, there is no electrical interconnection of the gold clusters.

Tour teaches construction of molecular devices in the form of single molecules. The molecular devices can be a two-terminal molecular wire with a tunneling barrier, a molecular wire with a quantum well (a resonant tunneling diode), three-terminal systems, and four-terminal systems. Tour teaches triggering these single molecules by changing the electrostatic potential (page 8487, column 1, paragraph 2). Tour also teaches changing the electrostatic potential in one molecule to send a signal to the next molecule (page 8488, column 1, paragraph 1). Tour explicitly states "there is no need for electron transfer, just a charge reshape" (page 8488, column 1, paragraph 1). Tour describes that the individual molecules have input and output ends, such as the molecular termini formed by molecular alligator clips.

There are a number of differences between Applicants' disclosure and the teachings of

Andres and Tour as discussed below.

First, Applicants' claim 58 describes interconnection of the plurality of molecular circuit components with at least a portion of the plurality of nanoparticles. The interconnection provides electrical continuity. Andres does not teach interconnection of gold clusters (nanoparticles) with themselves. In contrast, Andres teaches interconnection of gold clusters with a gold substrate through thiol monolayer molecules. Furthermore, interconnection of gold clusters with a gold substrate as taught by Andres does not result in electrical continuity, since the thiol monolayer molecules are insulators. Tour does not teach or suggest nanoparticles. Furthermore, Tour does not teach or suggest electrical continuity as disclosed by Applicants. Instead, Tour teaches changing electrostatic potential in operation of the single molecules as molecular devices.

Second, Applicants respectfully assert that the terms "input lead" and "output lead" as used in instant claim 58 are not the same as those taught by Tour. In the instant application, input leads and output leads refer to connections made to a nanocell. The molecular circuit components are bound to the input leads and output leads in some embodiments. In contrast, input leads and output leads as taught by Tour refer to the ends of individual molecular device molecules. As acknowledged by the Examiner, Andres is silent on input leads and output leads.

Third, as a consequence of Tour's definition of input leads and output leads, Tour does not teach or suggest a random nanonetwork spanning the input leads and the output leads. Instant claim 58 describes that a random nanonetwork comprises a plurality of molecular circuit components and a plurality of nanoparticles. The random nanonetwork spans the at least one input lead and the at least one output lead. As taught by Tour, the span between an individual molecular device input lead and output lead is inherently formed by the molecular structure not comprising the input lead and output lead. Consequently, there is no space in the span between the input lead and the output lead for nanoparticles, as taught by Tour. In light of the foregoing, Applicants respectfully assert that there is no motivation to combine the teachings of Tour with the nanoparticles taught by Andres. Tour's silence on nanoparticles has been noted hereinabove.

As discussed hereinabove, Andres and Tour do not teach the following claim limitations, either separately or in combination: 1) interconnection of molecular circuit components with

nanoparticles to provide electrical continuity, 2) nanocell input leads and output leads, or 3) a nanonetwork spanning the input and output leads. The Examiner is reminded that for rejections under 35 U.S.C. § 103(a), all claim limitations must be taught or suggested by the prior art to establish obviousness. *In re Royka,* 490 F.2d 981, 180 U.S.P.Q. 580 (C.C.P.A. 1974). Applicants respectfully assert that Andres and Tour do not teach or suggest all of the limitations of claim 58, as amended, either separately or in combination. Claims 59 – 76 depend either directly or indirectly from claim 58 and are patentable for at least the same reasons. *In re Fine,* 837 F.2d 1071, 5 U.S.PQ.2d 1596 (Fed. Cir. 1988). Therefore, withdrawal of the Examiner's rejection of claims 58 – 76 under 35 U.S.C § 103(a) in view of the remarks and amendments presented hereinabove is respectfully requested.

CONCLUSIONS

Applicants respectfully submit that Claims 58 – 76 are in a condition for allowance based on the remarks and amendments presented above.

If additional fees are due and are not included, the Director is hereby authorized to charge any fees or credit any overpayment to Deposit Account Number 23-2426 of Winstead PC (referencing matter 11321-P123US).

If the Examiner has any questions or comments concerning this paper or the present application in general, the Examiner is invited to call the undersigned at 713-650-2764.

Respectfully submitted,

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Date: November 21, 2008

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